

**IN THE DRAWINGS:**

**Please replace the drawings with the replacement sheets.**

### REMARKS

Claims 1 through 19 are in this application and are presented for consideration. Claims 1 through 13 have been amended. The amended claims present the same subject matter as the original claims but have been amended to adapt them to the U. S. style. The new claims present subject matter similar to the original claims, but in a different form.

The specification, claims and drawings have been amended in order to place this application in better form. The reference to claims in the specification has been deleted or amended. Appropriate headings have been added. No new matter has been added.

Favorable action on the merits is respectfully requested.

Respectfully submitted  
for Applicant,



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Enclosed: Substitute Specification and Marked up copy of Translation  
(5) Sheets of Replacement Drawings

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SHOULD ANY OTHER FEE BE REQUIRED, THE PATENT AND TRADEMARK OFFICE  
IS HEREBY REQUESTED TO CHARGE SUCH FEE TO OUR DEPOSIT ACCOUNT 13-  
0410.

**BALL AND SOCKET JOINT, PREFERABLY FOR USE IN  
VEHICLES**

**CROSS REFERENCE TO RELATED APPLICATIONS**

[0001] This application is a United States National Phase application of International Application PCT/DE 2005/000004 and claims the benefit of priority under 35 U.S.C. § 119 of German Patent Application DE 10 2004 001 465.5 filed January 8, 2004, the entire contents of which are incorporated herein by reference.

**FIELD OF THE INVENTION**

[0002] The present invention pertains to a ball and socket joint, preferably for use in vehicles, especially in the area of the chassis of motor vehicles, with a ball and socket joint housing having a joint opening, with a ball pivot, which is arranged in the ball and socket joint housing, extends through the joint opening and with which a shaft is made integral, with a support ring arranged on the shaft of the ball pivot and with a sealing element, which is arranged between

the support ring and a connection component surrounding the shaft of the ball pivot; ~~according to~~  
the preamble of claim 1.

## BACKGROUND OF THE INVENTION

5 [0003] It is usually necessary in ball and socket joints to guarantee the relative motion of  
the joint parts in relation to one another without limitations of the function at least over a service  
life preset for the type of ball and socket joint in question. There must be sufficient sealing against  
external effects, especially against the penetration of foreign bodies and moisture. Support rings,  
which are arranged on the ball pivot of the ball and socket joint and on which the pivot-side  
sealing labyrinth of a sealing bellows can be sealingly fixed, are used for this purpose.

10 [0004] A ball and socket joint for motor vehicles, which has a gasket made of an  
elastically deformable material between the housing of the ball and socket joint and a ball pivot  
carrying the joint ball, is known in this connection from DE-OS 37 05 847. A support ring, which  
is arranged adheringly on the ball pivot and meshes with the bearing surface of the gasket in a  
positive-locking manner, is inserted between the bearing surface of the gasket and the ball pivot.

15 [0005] Sealing is brought about in this solution in the area of the support ring by the  
support ring being provided with a coating consisting of an elastic material.

**[0006]** Furthermore, a ball and socket joint, which comprises essentially a ball pivot and a ball socket for holding the head of the ball pivot with a bearing inserted in between, is known from DE 103 00 678 A1. Furthermore, the ball and socket joint has a retaining ring, which comprises a cylindrical part, which is arranged on an outer circumferential surface of the shaft of the ball pivot, and a flange, which projects from one end of the cylindrical part of the retaining ring and comes into close contact with a fastening bead of a sleeve.

**[0007]** In connection with this teaching, the area in which the retaining ring is arranged on the shaft of the ball pivot is filled with a sealant, which penetrates as a liquid into recesses in this area.

## SUMMARY OF THE INVENTION

**[0008]** The basic object of the present invention is to perfect a ball and socket joint such that its ability to function is preserved over comparatively long periods of time regardless of the specific design of the joint, without being adversely affected by corrosion phenomena in the area of the ball pivot.

**[0009]** The object is accomplished according to the present invention on a ball and socket joint of the type described by the sealing element used to seal the shaft of the ball pivot being designed as an elastically and/or plastically deformable profiled body, whose effective cross section, which is free from the effect of forces, is limited by a continuously extending, curved

contour, which is subject to deformation in the installed state, as a result of which a partial area of the contour is in contact with the adjacent areas that are to be sealed.

**[0010]**\_\_\_\_\_ The present invention is associated with the advantage that based on the given elastic and/or plastic deformability of the profiled body, the material properties and the geometric shape of the profiled body, such as the contour of the cross section, can be selected in a specific manner such that the required sealing action is achieved depending on the installation position and the pretension exerted on the profiled body.

**[0011]**\_\_\_\_\_ To embody a selective sealing function of the sealing element designed as a profiled body, the elastically and/or plastically deformable profiled body has a profiled basic body and sealing segments in the embodiment of the present invention. The sealing segment in question can thus be specially adapted to the sealing function to be ensured in the particular case, among other things, by selecting the manner of its arrangement and its connection with the profiled basic body. At least some of the sealing segments preferably extend here essentially in the radial direction relative to the profiled basic body.

**[0012]**\_\_\_\_\_ To control the deflection behavior of the sealing segment in a use-dependent manner, optionally for achieving a corresponding response behavior for a certain number of sealing segments, transition areas, which are shaped and whose material is selected such that

elastic and pretension-related deflection of the sealing segment adjoining the particular transition area is ensured, may be provided for connecting the profiled basic body with the sealing segments.

**[0013]** \_\_\_\_\_ In a preferred embodiment of the present invention, the profiled body has a connection surface, via which the profiled body is connected to an adjoining component.

5     **[0014]** \_\_\_\_\_ The adjoining component is preferably a support ring, which is to be arranged on the ball pivot of the ball and socket joint. The connection between the profiled body and the support ring may be established by vulcanization or by bonding.

10     **[0015]** \_\_\_\_\_ It is also possible to position the profiled body on the shaft of the ball pivot or the support ring in preparation for the mounting of the ball and socket joint. The profiled body may be expediently positioned as a result of a radial expansion of the profiled body by positive locking and/or non-positive locking on the component in question.

15     **[0016]** \_\_\_\_\_ In another preferred embodiment of the present invention, the support ring has a radially extending flange, with which at least one sealing segment of the profiled body is in contact under pretension. In addition as well as as an alternative hereto, at least one sealing segment of the profiled body may be in contact with the radially outer front surface of the flange of the

support ring under pretension, so that a redundant sealing system can be created on this basis.

[0017] To create defined elasticity and sealing conditions, the profiled body may have stabilizing elements, which may be designed as a strip or round bars and are used to stabilize the core structure of the transition areas to the sealing segments and the sealing segments themselves.

5 [0018] The present invention shall be explained in more detail below on the basis of an exemplary embodiment and corresponding drawings.

~~In the drawings,~~

Figure 1 shows The various features of novelty which characterize the invention are pointed out with particularity in the claims annexed to and forming a part of this disclosure. For a better understanding of the invention, its operating advantages and specific objects attained by its uses, reference is made to the accompanying drawings and descriptive matter in which preferred embodiments of the invention are illustrated.

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#### BRIEF DESCRIPTION OF THE DRAWINGS

[0019] In the drawings:

15 [0020] Figure 1 is a synoptic view of a hinge joint designed as a ball and socket joint with



a profiled body according to the present invention;

Figures 2-4 show [0021] Figure 2A is a sectional views of a detail X according to  
Figure 1 with a profiled ~~bodies~~body, which ~~are~~is installed and ~~are~~is thus in the pretensioned state  
and ~~are different from one another, the~~ profiled body differing from the other profiled bodies of  
5 the other embodiments in terms of their cross-sectional contours, and

Figure 5 shows a;

[0022] Figure 2B is a side view showing the profiled body of Figure 2A in a tension-free  
state;

[0023] Figure 3A is a sectional view of a detail X according to Figure 1 with a profiled  
10 body, which is installed and is thus in the pretensioned state, the profiled body differing from the  
other profiled bodies of the other embodiments in terms of their cross-sectional contours;

[0024] Figure 3B is a side view showing the profiled body of Figure 3A in a tension-free  
state;

[0025] Figure 4A is a sectional view of a detail X according to Figure 1 with a profiled  
15 body, which is installed and is thus in the pretensioned state, the profiled body differing from the  
other profiled bodies of the other embodiments in terms of their cross-sectional contours;

[0026] Figure 4B is a side view showing the profiled body of Figure 4A in a tension-free state;

[0027] Figure 5A is a side sectional view of ~~other~~another, non-pretensioned profiled bodies-

5 The;

[0028] Figure 5B is a side sectional view of another, non-pretensioned profiled bodies;

[0029] Figure 5C is a side sectional view of another, non-pretensioned profiled bodies;

[0030] Figure 5D is a side sectional view of another, non-pretensioned profiled bodies;

[0031] Figure 5E is a side sectional view of another, non-pretensioned profiled bodies;

10 and

[0032] Figure 5F is a side sectional view of another, non-pretensioned profiled bodies;

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0033] Referring to the drawings in particular, the hinge joint shown schematically in

Figure 1 is a ball and socket joint with some features known per se to the person skilled in the art.

15 The presentation of the design of the ball and socket joint can therefore be limited to the most

important elements.

**[0034]**\_\_\_\_\_ The ball and socket joint comprises essentially a ball pivot 1, a bearing shell 2 and a housing 3, which surrounds the ball pivot 1 and the bearing shell 2 at least partially. The ball and socket joint is sealed in the transition area from the housing 3 to the ball pivot 1 by a sealing bellows 4, which is held in the sealing position by means of the support ring 5, the round straining ring 6 and the flat straining ring 7 and makes possible a change in the relative position of the ball pivot 1 in relation to the housing 3.

**[0035]**\_\_\_\_\_ The housing 3 is, itself, of a two-part design and comprises a housing basic body 8 and a closing cover 9, which closes the housing 3 on the side facing away from the ball pivot 1 after the insertion of the ball pivot 1 into the housing basic body 8.

**[0036]**\_\_\_\_\_ The ball pivot 1 has a conically extending shaft 10, which is connected to a connection component 11 in a positive-locking and non-positive manner ~~and~~. The conically extending shaft 10 carries the support ring 5, which is in turn formed from a basic web 12 that is in contact with the shaft 10 of the ball pivot 1 and a flange 13 extending at an angle to the basic web 12.

**[0037]**\_\_\_\_\_ The flange 13 of the support ring 5 and a reference surface 14 of the connection component 11 are separated at least partially by a pretensioned sealing element, which is designed as a profiled body 15. Since the sealing action of the profiled body 15 develops at a radially spaced location from the circumferential surface of the shaft 10 of the ball pivot 1, effective protection of the ball pivot 1 against corrosion is achieved.

**[0038]**\_\_\_\_\_ Figures 2 through 4 show different profiled bodies 15 in both the tension-free state and the pretensioned installed position in the ball and socket joint. They comprise a profiled basic body 16 each with transition areas 17, which are joined by sealing segments 18. The continuously extending contour 19 of the sealing cross section of the profiled body 15, which contour is relevant for the sealing action, is determined by the sealing segments 18. For example, an especially efficient sealing action is achieved in the case of the profiled body 15 shown in Figure 2 by the two radially outer sealing segments 18 forming together a first barrier produced between the flange 13 of the support ring 5 and the reference surface 14 of the connection component 11 and by there being multiple redundancy due to the fact that a third and fourth sealing segment 18 are sealingly in contact with the shaft 10 of the ball pivot 1 under pretension.

**[0039]**\_\_\_\_\_ Sealing of the shaft 10 of the ball pivot 1 is achieved in profiled bodies 15 provided with sealing segments 18 essentially by compression or bending of the sealing segment 18 in question, which takes place under the action of force, and, in the presence of transition areas, by a deflection of the sealing segments 18 as a consequence of the elastic properties of the transition

areas 17.

**[0040]**\_\_\_\_\_The sealing segments 18 have large volumes in the profiled body 15 shown in Figure 3, which has an elongated design, so that a sealing segment is brought two-dimensionally into contact with the shaft 10 of the ball pivot 1, on the one hand, and the sealing segment 18 located opposite this extends around the flange 13 of the support ring 5 and comes into contact with the front surface 20 of the flange 13, on the other hand.

**[0041]**\_\_\_\_\_Regardless of the embodiment selected, it is within the scope of the present invention to combine sealing segments 18 of different shapes on a profiled body 15 in order to achieve the desired sealing action at the particular sealing position of the sealing segment 18 and to create a redundant sealing system by the cooperation of the sealing segments 18.

**[0042]**\_\_\_\_\_The peculiarity of the profiled body 15 shown in Figure 4 is especially that the transition areas 17 pass over into the profiled basic body 16 and into the sealing segments 18 with continuously extending radii of curvature, so that the sealing action of the entire profiled body 15 is also determined by the elastic properties of the profiled basic body 16.

**[0043]**\_\_\_\_\_Figure 5 shows a selection of other preferred cross-sectional shapes of profiled

bodies 15, which makes it possible to obtain an efficient sealing action. Shapes that contain sealing segments 18 and transition areas 17 to the profiled basic body 16 as desired as well as shapes in which sealing segments 18 may be omitted with respect to the application of the profiled body 15 have been selected. Depending on the concrete application and the desired sealing action, it is within the scope of the present invention to provide the profiled bodies 15 with stabilizing elements 21.

**[0044]** \_\_\_\_\_Based on the sealing elements presented within the framework of the present invention, which are designed as profiled bodies, it is possible to select the particular, suitable sealing element as a function of the site of installation of the ball and socket joint and the necessary sealing function.

**List of Reference Numbers**

- 1 — Ball pivot
- 2 — Bearing shell
- 5 3 — Housing
- 4 — Sealing bellows
- 5 — Support ring
- 6 — Round straining ring
- 7 — Flat straining ring
- 10 8 — Housing basic body
- 9 — Closing cover
- 10 — Shaft
- 11 — Connection component
- 12 — Basic web
- 15 13 — Flange
- 14 — Reference surface
- 15 — Profiled body
- 16 — Profiled basic body
- 17 — Transition areas
- 20 18 — Sealing segments
- 19 — Contour

20 — Front surface

21 — Stabilizing element



~~Ball and Socket Joint, Preferably for Use in Vehicles~~

~~Abstract~~

[0045] While specific embodiments of the invention have been shown and described in detail to illustrate the application of the principles of the invention, it will be understood that the invention may be embodied otherwise without departing from such principles.